Rapid Variability Generated at Relativistic Shocks Simulated by Particle-in-Cell Code

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Plasma instabilities excited in collisionless shocks are responsible for particle acceleration. We have investigated the particle acceleration and shock structure associated with an unmagnetized relativistic electron-positron jet propagating into an unmagnetized electron-positron plasma. Cold jet electrons are thermalized and slowed while the ambient electrons are swept up to create a partially developed hydrodynamic-like shock structure. In the leading shock, electron density increases by a factor of about 3.5 in the simulation frame. Strong electromagnetic fields are generated in the trailing shock and provide an emission site. These magnetic fields contribute to the electrons transverse deflection behind the shock. We calculate the radiation from deflected electrons in the turbulent magnetic fields. Radiation from electrons near the trailing shock will be variable due to fluctuations of density and electromagnetic fields. The properties of this radiation may be important for rapid variability in relativistic jets such as AGN jets and blazars.